

In the Claims:

Please amend claims 1-4 and 7-9, cancel claims 10 and 11 without estoppel or disclaimer of the subject matter thereof, and add new claims 12-20, as follows:

1. (Currently Amended) An automatic work apparatus for carrying out predetermined tasks, comprising:

plural observing camera devices ~~detects spatial position of targets based on images thereof taken by means of plural observing camera devices that have~~
comprise lenses of non-central projection such as comprising fisheye lenses set therein, each of the lenses of non-central projection providing a central area and an edge area around the central area, of field of view thereof, the central area having a higher certainty than the edge area in determining a distance from automatic work apparatus to the target ~~and carries out predetermined tasks;~~

a rotation device to change viewing direction of ~~said~~ the observing camera devices;

a target image extracting unit to extract ~~said targets~~ a target in ~~said~~ images taken by ~~means of said~~ the plural observing camera devices;

a view position determining unit to determine view positions of the target in field of view of the observing cameras;

a spatial position determining unit to determine a direction and a distance as a spatial position of the target in accordance with the view positions;

a certainty determining unit to determine a certainty in determining the distance using the view positions and data regarding the central area and the edge area; and

a rotation controller to control~~said the~~ rotation device to change the viewing direction of the observing camera devices in accordance with the determined certainty ~~a certainty obtained by discriminating the target position information in response to target position that is specified by said target image extracting unit for each of said images of said targets.~~

2. (Currently Amended) An automatic work apparatus for carrying out predetermined tasks, comprising:

~~which specifies spatial position of targets based on images thereof taken by means of plural observing camera devices that have comprises lenses of non-central projection comprising such as fisheye lenses set therein and carries out predetermined tasks,~~ each of the lenses of non-central projection providing a central area and an edge area around the central area, of field of view thereof, the central area having a higher accuracy than the edge area in determining a distance from the automatic work apparatus to the target, comprising:

~~a rotation device to change viewing direction of said observing camera devices;~~

a first device to effect a first movement regarding a direction;

a second device to effect a second movement regarding the direction and a distance;

a target image extracting unit to extract ~~said targets~~ the target in ~~said the~~ images taken by ~~means of said the~~ plural observing camera devices;

a view position determining unit to determine view positions of the target in field of view of the observing cameras;

a spatial position determining unit to determine a direction and the distance as a spatial position of the target in accordance with the view positions;

a target position determining unit to determine whether the target is in either of the central area or the edge area in accordance with the view position;

~~a position determining unit to determine said the spatial positions of said targets by using image positions of said targets specified by said target image extracting unit; and~~

~~a rotation controller to control said rotation device so that said rotation device changes to change a viewing direction of said the observing camera devices which take images, wherein at least two areas as a peripheral area and a central area are assigned to said images, of said targets in said central area in case that image positions of said targets specified by said target image extracting unit are in said peripheral area~~ the first device to effect the first movement regarding the direction in accordance with the determined direction when the target is in the edge

area and the second device when the target is in the central area to effect a second movement regarding the direction and the distance.

3. (Currently Amended). An automatic work apparatus according to Claim 2, ~~having;~~

wherein the second device comprises an transfer equipment to change relative distance with ~~said the~~ targets so that ~~said the~~ predetermined tasks are carried out by adjusting relative position against ~~said the~~ target on a basis of spatial positions of ~~said the~~ targets determined by ~~said the~~ position determining unit.

4. (Currently Amended) An automatic work apparatus according to Claim 2 wherein;

said target image extracting unit has a function to extract said targets from said images taken by ~~means of the~~ plural observing camera devices by specifying only picture elements that correspond to a reference color which is assigned for said targets and memorized for identifying said targets beforehand.

5. (Original) An automatic work apparatus according to Claim 4 wherein;

said extracted target image by said target image extracting unit is labeled with a single same ID onto plural picture elements which keep a connectivity thereover so that said plural picture elements specify said target.

6. (Original) An automatic work apparatus according to Claim 5

wherein;

said target image extracting unit has a function to determine an identification of said targets specified by composures of said picture elements that correspond to a reference color which is assigned for said targets with said targets on a basis of predetermined aspect value after computing an aspect ratio of planar expansion of said picture elements.

7. (Currently Amended) An automatic work apparatus according to Claim 4 wherein;

said target image extracting unit has a function to determine an identification of said targets specified by composures of said picture elements that correspond to a reference color which is assigned for said targets with said targets on a basis of predetermined filling rate of said composures of said picture elements against a rectangular given by a vertical viewing angle and a horizontal viewing angle in a viewing angle mapping specified by said images taken by ~~means of~~ the plural observing camera devices.

8. (Currently Amended) An automatic work apparatus according to Claim 4 wherein;

said images taken by ~~means of~~ the plural observing camera devices are sampled with respect to colors and said reference color which is assigned for said

targets is determined by eliminating a color of which area expands from the origin of Cr-Cb space chart after plotting said sampled color onto Cr-Cb space.

9. (Currently Amended) An automatic work apparatus according to Claim 2 having two observing camera devices set in right hand side and left hand side thereof, wherein;

said position determining unit comprises a distance computing module that determines distance to said target therefrom using position information of said target image specified by said target image extracting unit, a horizontal position computing module that computes horizontal position to said target using position information of said target image specified by said target image extracting unit and a vertical position computing module that computes vertical position to said target using position information of said target image specified by said target image extracting unit,

three categories of areas as a left or right peripheral area, an upper or lower peripheral area and a central area are set for each image taken by said observing camera device,

a rotation controller controls a rotational drive unit to rotate said observing camera devices when said target images locate in said left or right peripheral area,

an image processing for said target of which image locates in an upper and lower peripheral area of said image taken by said observing camera devices is

carried out in such a way that horizontal position in a horizontal plane is determined by computing distance to said target by ~~means of~~ said distance computing module as well as horizontal position of said target is computed by said horizontal position computing module,

an image processing for said target of which image locates in central area of said image taken by said observing camera devices is carried out in such a way that spatial position of said target is determined by computing distance, horizontal position and vertical position to said target by ~~means of~~ said distance computing module, horizontal position computing module and vertical position computing module, and

a predetermined work starts to be carried out after adjusting a relative position between said target and said automatic work apparatus on a basis of said horizontal position in a horizontal plan and said spatial position of said target.

10-11. (Canceled).

12. (New) An automatic work apparatus which specifies spatial position of targets based on images thereof taken by plural observing camera devices that have lenses of non-central projection such as fisheye lenses set therein and carries out predetermined tasks comprising:

a rotation device to change viewing direction of said observing camera devices;

a target image extracting unit to extract said targets in said images taken by said plural observing camera devices by specifying only picture elements that correspond to a reference color which is assigned for said targets and memorized for identifying said targets beforehand, said extracted target image by said target image extracting unit being labeled with a single same ID onto plural picture elements which keep a connectivity thereover so that said plural picture elements specify said target;

said target image extracting unit determining an identification of said targets specified by composites of said picture elements that correspond to a reference color which is assigned for said targets on a basis of predetermined aspect value after computing an aspect ratio of a planar expansion of said picture elements.

a position determining unit to determine said spatial positions of said targets by using image positions of said targets specified by said target image extracting unit; and

a rotation controller to control said rotation device so that said rotation device changes viewing direction of said observing camera devices which take images, wherein at least two areas as a peripheral area and a central area are assigned to said images, of said targets in said central area in case that image positions of said targets specified by said target image extracting unit are in said peripheral area.

13. (New) An automatic work apparatus which specifies spatial position of targets based on images thereof taken by plural observing camera devices that have lenses of non-central projection such as fisheye lenses set therein and carries out predetermined tasks comprising:

a rotation device to change viewing direction of said observing camera devices;

a target image extracting unit to extract said targets in said images taken by said plural observing camera devices by specifying only picture elements that correspond to a reference color which is assigned for said targets and memorized for identifying said targets beforehand;

said target image extracting unit determining an identification of said targets specified by composites of said picture elements that correspond to a reference color which is assigned for said targets on a basis of predetermined filling rate of said composites of said picture elements against a rectangular field formed by a vertical viewing angle and a horizontal viewing angle in a viewing angle mapping specified by said images taken by plural observing camera devices;

a position determining unit to determine said spatial positions of said targets by using image positions of said targets specified by said target image extracting unit; and

a rotation controller to control said rotation device so that said rotation device changes viewing direction of said observing camera devices which take images, wherein at least two areas as a peripheral area and a central area are assigned to said images, of said targets in said central area in case that image positions of said targets specified by said target image extracting unit are in said peripheral area.

14. (New) An automatic work apparatus which specifies spatial position of targets based on images thereof taken by plural observing camera devices that have lenses of non-central projection such as fisheye lenses set therein and carries out predetermined tasks comprising:

a rotation device to change viewing direction of said observing camera devices;

a target image extracting unit to extract said targets in said images taken by said plural observing camera devices by specifying only picture elements that correspond to a reference color which is assigned for said targets and memorized for identifying said targets beforehand;

said images taken by plural observing camera devices are sampled with respect to colors and said reference color which is assigned for said targets is determined by eliminating a color of which area expands from the origin of Cr-Cb space chart after plotting said sampled color onto Cr-Cb space;

a position determining unit to determine said spatial positions of said targets by using image positions of said targets specified by said target image extracting unit; and

a rotation controller to control said rotation device so that said rotation device changes viewing direction of said observing camera devices which take images, wherein at least two areas as a peripheral area and a central area are assigned to said images, of said targets in said central area in case that image positions of said targets specified by said target image extracting unit are in said peripheral area.

15. (New) An automatic work apparatus which specifies spatial position of targets based on images thereof taken by two observing camera devices set in right hand side and left hand side thereof that have lenses of non-central projection such as fisheye lenses set therein and carries out predetermined tasks comprising:

a rotation device to change viewing direction of said observing camera devices;

a target image extracting unit to extract said targets in said images taken by said plural observing camera devices, each image taken by an observing camera device sets three categories of areas as a left or right peripheral area, an upper or lower peripheral area and a central area;

a position determining unit to determine said spatial positions of said targets by using image positions of said targets specified by said target image extracting unit;

said position determining unit comprises a distance computing module that determines distance to said target therefrom using position information of said target image specified by said target image extracting unit, a horizontal position computing module that computes horizontal position to said target using position information of said target image specified by said target image extracting unit and a vertical position computing module that computes vertical position to said target using position information of said target image specified by said target image extracting unit;

a rotation controller to control said rotation device so that said rotation device changes viewing direction of said observing camera devices which take images when said target images locate in said left or right peripheral area, wherein at least two areas as a peripheral area and a central area are assigned to said images, of said targets in said central area in case that image positions of said targets specified by said target image extracting unit are in said peripheral area;

an image processor for said target of which the image locates in an upper and lower peripheral area of said image taken by said observing camera devices is carried out in such a way that horizontal position in a horizontal plane is

determined by computing distance to said target by said distance computing module as well as horizontal position of said target is computed by said horizontal position computing module;

an image processor for said target of which the image locates in central area of said image taken by said observing camera devices is carried out in such a way that spatial position of said target is determined by computing distance, horizontal position and vertical position to said target by said distance computing module, horizontal position computing module and vertical position computing module, wherein the automatic work apparatus starts to carry out a predetermined work after adjusting a relative position between said target and said automatic work apparatus on a basis of said horizontal position in a horizontal plane and said spatial position of said target.

16. (New) The automatic work apparatus according to claim 2, wherein the first devices comprises a rotation device to change viewing direction of the observing camera devices.

17. (New) The automatic work apparatus according to claim 2, wherein the second device approaches the target as the second movement.

18. (New) The automatic work apparatus according to claim 2, wherein the plural observing camera devices arranged in a horizontal direction, the edge area includes an area extending along the horizontal direction and arranged in a

vertical direction, and wherein the second device effects a horizontal movement toward the target as the second movement without a vertical movement.

19. (New) A program in a storage medium for operating a computer included in an automatic work apparatus for carrying out predetermined tasks, the automatic work apparatus further including: plural observing camera devices that comprises lenses of non-central projection comprising fisheye lenses set therein, each of the lenses of non-central projection providing a central area and an edge area around the central area, of field of view thereof, the central area having a higher certainty than the edge area in determining a distance from automatic work apparatus to the target; a rotation device to change viewing direction of the observing camera devices, the program comprising:

- a target image extracting part to extract the target in the images taken by the plural observing camera devices;

- a view position determining part to determine view positions of the target in fields of view of the observing camera devices;

- a spatial position determining part to determine a direction and the distance as a spatial position of the target in accordance with the view positions;

- a certainty determining part to determine a certainty in detecting the distance using the view position and data of at least one of the central area and the edge area; and

a controlling part to control the rotation the first device to effect the first movement regarding the direction in accordance with the determined certainty.

20. (New) A program in a storage medium for operating a computer included in an automatic work apparatus which further includes: plural observing camera devices that have lenses of non-central projection; a first device to effect a first movement regarding a direction; and a second device to effect a second movement regarding the direction and a distance; the automatic work apparatus specifying a spatial position of a target based on images thereof taken by plural observing camera devices that comprise lenses of non-central projection, each of the lenses of non-central projection providing a central area and an edge area around the central area, of field of view thereof, the central area having a higher accuracy than the edge area in determining a distance from the automatic work apparatus to the target, comprising:

a target image extracting part to extract the target in the images taken by the plural observing camera devices;

a view position determining part to determine view positions of the target in fields of view of the observing cameras;

a spatial position determining part to determine a direction and the distance as a spatial position of the target in accordance with the view positions;

a target position determining part to determine whether the target is in the central area or the edge area in accordance with the view positions; and

a controlling part to control the first device to effect the first movement regarding the direction in accordance with the determined direction when the target is in the edge area and the second device when the target is in the central area to effect the second movement regarding the direction and the distance.